

We claim:

1. A coated multilayer structure comprising:
a polymeric base layer;
5 a zero valent material barrier layer; and
a top coat on the zero valent material barrier layer, the top coat comprising
a soluble compound capable of reducing the permeability of the multilayer structure to
gas or vapor.
- 10 2. A coated multilayer structure as in claim 1 wherein the zero valent
material barrier layer is a barrier to transmission of ultraviolet light.
3. A coated multilayer structure as in claim 1 wherein the zero valent
material barrier layer is a metal coating.
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4. A coated multilayer structure as in claim 1 wherein the zero valent
material barrier layer is a silicon, aluminum, nickel, chromium or copper coating.
5. A coated multilayer structure as in claim 1 wherein the zero valent
20 material barrier layer is a silicon coating.
6. A coated multilayer structure as in claim 1 wherein the zero valent
material barrier layer is an aluminum coating.
- 25 7. A coated multilayer structure as in claim 1 wherein the multilayer structure
has an ultraviolet light transmission of less than 5 % at 380 nm wavelength.
8. A coated multilayer structure as in claim 1 wherein the soluble compound
has a carboxyl, hydroxyl, or carboxamide functional group.
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9. A coated multilayer structure as in claim 1 wherein the soluble compound is in a solid state at a temperature of 25 °C and atmospheric pressure.
10. A coated multilayer structure as in claim 1 wherein the soluble compound is nonreactive with the zero valent material barrier layer.
11. A coated multilayer structure as in claim 1 wherein the soluble compound is nontoxic.
12. A coated multilayer structure as in claim 1 wherein the soluble compound is polymeric.
13. A coated multilayer structure as in claim 6 wherein the polymeric soluble compound is selected from the group consisting of carboxymethyl cellulose, poly(acrylamide), polydextrose, poly(acrylic acid), and poly(vinyl alcohol).
14. A coated multilayer structure as in claim 1 wherein the soluble compound is monomeric.
15. A coated multilayer structure as in claim 14 wherein the monomeric soluble compound is selected from the group consisting of sucrose, caramel, and citric acid.
16. A coated multilayer structure as in claim 1 wherein soluble compound is water soluble and is applied to the zero valent material barrier layer in an aqueous solution.
17. A coated multilayer structure as in claim 16 wherein the soluble compound, when in the aqueous solution, is in the form of molecules having a maximum dimension less than one micron.

18. A coated multilayer structure as in claim 1 wherein the zero valent material barrier layer has pinholes and the top coat is at least partially disposed in the pinholes.

5 19. A coated multilayer structure as in claim 1 wherein the zero valent material barrier layer is applied to the base layer with vapor deposition or sputtering.

20. A coated multilayer structure as in claim 1 wherein the base layer is a thermoplastic layer.

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21. A coated multilayer structure as in claim 1 wherein the base layer is polyethylene terephthalate.

22. A coated multilayer structure as in claim 1 wherein the multilayer structure is a container.

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23. A coated multilayer structure as in claim 22 wherein the base layer forms a container body and the zero valent material barrier layer is on an exterior surface of the container body.

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24. A packaged beverage comprising a container as in claim 22 and a beverage disposed in the container.

25. A packaged beverage as in claim 24 wherein the beverage is a carbonated beverage.

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26. A packaged beverage as in claim 24 wherein the beverage is beer.

27. A coated multilayer structure comprising:
a polymeric base layer; and

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a zero valent material barrier layer, wherein the zero valent material barrier layer is a barrier to transmission of ultraviolet light.

5 28. A coated multilayer structure as in claim 27 wherein the zero valent material barrier layer is a silicon coating.

29. A coated multilayer structure as in claim 27 wherein the multilayer structure has an ultraviolet light transmission of less than 5 %.

10 30. A coated multilayer structure as in claim 27 wherein the zero valent material barrier layer is applied to the base layer with vapor deposition or sputtering.

31. A coated multilayer structure as in claim 27 wherein the base layer is a thermoplastic layer.

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32. A coated multilayer structure as in claim 27 wherein the base layer is polyethylene terephthalate.

20 33. A coated multilayer structure as in claim 27 wherein the multilayer structure is a container.

34. A coated multilayer structure as in claim 33 wherein the base layer forms a container body and the zero valent material barrier layer is on an exterior surface of the container body.

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35. A coated multilayer structure as in claim 27 further comprising an inorganic oxide gas barrier layer.

30 36. A coated multilayer structure as in claim 35 further comprising a top coat comprising a soluble compound capable of reducing the permeability of the multilayer structure to gas or vapor.

37. A coated multilayer structure as in claim 35 wherein the zero valent material barrier layer is a silicon coating.
- 5 38. A coated multilayer structure as in claim 37 wherein the inorganic oxide gas barrier layer is an SiOx coating.
39. A coated multilayer structure as in claim 38 further comprising a top coat comprising a soluble compound capable of reducing the permeability of the multilayer structure to gas or vapor.
- 10 40. A packaged beverage comprising a container as in claim 33 and a beverage disposed in the container.
- 15 41. A packaged beverage as in claim 40 wherein the beverage is a carbonated beverage.
42. A packaged beverage as in claim 40 wherein the beverage is beer.
- 20 43. A method for reducing the permeability of vapor or gas through a multilayer structure comprising a polymeric base layer and a zero valent material barrier layer on a surface of the polymeric base layer, the method comprising applying to the zero valent material barrier layer a top coat comprising a soluble compound capable of reducing the permeability of the multilayer structure to gas or vapor.
- 25 44. A method as in claim 43 wherein the zero valent material barrier layer is a barrier to transmission of ultraviolet light.
- 30 45. A method as in claim 43 wherein the zero valent material barrier layer is a metal coating.

46. A method as in claim 43 wherein the zero valent material barrier layer is a silicon, aluminum, nickel, chromium or copper coating.
- 5 47. A method as in claim 43 wherein the zero valent material barrier layer is a silicon coating.
48. A method as in claim 43 wherein the zero valent material barrier layer is an aluminum coating.
- 10 49. A method as in claim 43 wherein the multilayer structure has an ultraviolet light transmission of less than 5 %.
50. A method as in claim 43 wherein the soluble compound has a carboxyl, hydroxyl, or carboxamide functional group.
- 15 51. A method as in claim 43 wherein the soluble compound is in a solid state at a temperature of 25 degrees C and atmospheric pressure.
52. A method as in claim 43 wherein the soluble compound is nonreactive
- 20 with the zero valent material barrier layer.
53. A method as in claim 43 wherein the soluble compound is nontoxic.
54. A method as in claim 43 wherein the soluble compound is polymeric.
- 25 55. A method as in claim 54 wherein the polymeric soluble compound is selected from the group consisting of carboxymethyl cellulose, poly(acrylamide), polydextrose, poly(acrylic acid), and poly(vinyl alcohol).
- 30 56. A method as in claim 43 wherein the soluble compound is monomeric.

57. A method as in claim 56 wherein the monomeric soluble compound is selected from the group consisting of sucrose, caramel, and citric acid.

58. A method as in claim 43 wherein the soluble compound is water soluble
5 and the step of applying the soluble compound comprises applying the water soluble compound to the zero valent material barrier layer in an aqueous solution.

59. A method as in claim 58 wherein the soluble compound, when in the aqueous solution, is in the form of molecules having a maximum dimension less than one
10 micron.

60. A method as in claim 43 wherein the zero valent material barrier layer has pinholes and the top coat is at least partially disposed in the pinholes.

61. A method as in claim 43 wherein the zero valent material barrier layer is applied to the base layer with vapor deposition or sputtering.
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62. A method as in claim 43 wherein the base layer is a thermoplastic layer.

63. A method as in claim 43 wherein the base layer is polyethylene terephthalate.
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64. A method as in claim 43 wherein the multilayer structure is a container.

65. A method as in claim 64 wherein the base layer forms a container body and the zero valent material barrier layer is applied to an exterior surface of the container body.
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66. A method of packaging a beverage comprising:
30 providing a container comprising a polymeric container body and an zero valent material barrier layer on an exterior surface of the container body;

applying to the zero valent material barrier layer a top coat comprising a soluble compound capable of reducing the permeability of the container to gas or vapor; and depositing a beverage in the container.

5 67. A method as in claim 66 wherein the beverage is a carbonated beverage.

 68. A method for producing recycled content plastic comprising the steps of:
 providing a batch plastic, at least a portion of the batch plastic comprising a
coated multilayer structure comprising a polymeric base layer and a zero valent material
10 barrier layer on a surface of the polymeric base layer, wherein the zero valent material
barrier layer is a barrier to transmission of ultraviolet light;
 chemically removing the zero valent material barrier layer; and
 converting the batch plastic to a form suitable for melt extrusion.

15 69. A method as in claim 68 wherein the zero valent material barrier layer is a
silicon coating.

 70. A method as in claim 68 wherein the coated multilayer structure is a
container.

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